LT. COL. J. W. VARIAN, QMC, 0-206858

A SURVEY OF GERMAN TACTICS 1918

Historical Section, General Staff

Tactical Studies, No. 1

Printed at
The Base Printing Plant
29th Eng'rs, U. S. Army
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I

A SURVEY OF GERMAN TACTICS DURING THE CAMPAIGN OF 1918

GENERAL SURVEY

A survey of German tactics during 1918 is facilitated by the dramatic change that came over the situation on the 18th of July. Up to that date we are concerned with offensive tactics; after that date only with defensive. The subject thus naturally divides in two.

At the head of the German Army as the spring campaign opened was Field Marshal von Hindenburg, an exponent of offensive tactics, who had up till then, and quite recently in the attack on Riga, met with remarkable successes. In the early phases of the war, and on the Eastern front, Hindenburg had more or less practiced von Schlieffen's *Cannae* theory,—the refusal of the centre and double envelopment of the wings. With the immense frontal developments of the later stages of the war, this tactical scheme became less and less workable and the tendency became rather to search out and exploit a weak point in the opponent's line. By making a sufficient effort to break through at such a point, envelopment could then again be practiced; though in this case from the center outwardly to the wings. The adjustment of the armies on the Western front so clearly precluded the possibility of envelopment without the previous break through that it may be assumed that this method was firmly fixed in the German Field Marshal's mind when the spring campaign opened.

It is now a well-known fact that the Allies created such a weak point in their line as Hindenburg would naturally seek for, to the south of the Somme, in the early part of the year. Not only did this open the opportunity for breaking through, but it did so at a point where the prospective strategic results for the Germans were possibly greater than at any other point of the front. What followed is well known: a successful break through; two or three days of immense advantages reaped through lateral envelopment turning both north and south; but eventual stabilization of the lines before the German Command could turn their great success to decisive profit.

In the lesser offensives that followed, down to that of the 27th of May on the Aisne, the same fundamental idea is at work; but these are less skillfully conducted and the resistance is stronger, save in the last case. On the Aisne, the German success in breaking through

a most dangerously weakened part of the Allied line was even greater than in March, that is to say, the advance was more rapid and the penetration, relatively to the front, deeper. But, on the other hand, the setting up of a lateral envelopment either eastwards towards Epernay-Chalons-Verdun or westwards towards Meaux-Paris, did not materialize.

Even after the Allied resistance had been to a large extent shattered, the German Command showed little ability to free itself from an over-methodical estimate of the situation, and to take really bold and military decisions. What with this, and the geometrically increasing difficulty of supply as penetration is effected, the large successes won were not adequately exploited in the direction of decisive success.

In the partial successes of these German offensive movements which we have noted, no factor played a more important part than surprise. Military theorists have always agreed on the supreme importance of surprise, and the experience of the present war wholly confirms this view. But the present day conditions of surprise represent an extremely delicate and complex adjustment when we compare them with those of previous wars. The "fog" that enveloped armies in the past has largely disappeared, that is, if not in the obvious sense, in the practical sense that the opponent can be pretty closely located on the map; while the stricter and increasingly computable relation between troops and supply lines, together with the ever increasing delaying power of the defensive arising from improved materiel, both tend to make the problems more closely calculable.

Without taking the space necessary for reviewing all the elements in the case, it may be said summarily that under the conditions of the Western front surprise was both more important and more difficult to secure than under normal conditions. Both sides during 1918 devoted immense efforts to securing secrecy on the one hand and on the other quicker tactical methods; and each of these was an equal element in surprise. Attention is called to the cases cited in the second part of elaborate precautions taken to preserve secrecy, and to the numerous devices adopted in the adjustment of infantry and artillery for the tactical shock, of which the general tendency can be summarized now. This general tendency,—that is, in the attempts to gain tactical advantages by new adjustments,—was generally in the direction of securing greater rapidity of movement while not unduly sacrificing fire effect. In other words, while the infantry attack was quickened up to a point at which it outdistanced most of its supporting artillery, its fire effect was heightened by the development of the class of weapons that ranges between the rifle and the field gun.

Incidentally to this it may be remarked that much of what has occurred during the course of 1918 confirms very strongly the position

that the old rigid line between artillery and infantry must be broken down. The real test of the class to which a firearm belongs should be its mobility, that is, whether or not it is mobile enough to be employed in conjunction with rapidly advancing infantry in the field. A gun which at the present day is unable to do this, may enter within the category tomorrow, owing to some improvement in tractor or other mechanism.

Suddenly placed on the defensive by one of the most remarkable reverses in history, the German Command felt its way to a defensive tactical scheme based on previous experience: the most vivid chapters of that experience had been written during the summer and autumn of 1917 by the British at Ypres. There the Germans had boxed the tactical compass. Starting with a rigid and strongly-held front line they had been compelled by constantly intensified artillery fire to adopt a disposition in depth. But this proved not wholly satisfactory, for it was soon found that a forefield insufficiently supported with artillery had to be abandoned gradually to a persistent enemy. Various schemes of counter-attacking were then tried and successfully met by the British, so that by the end of the year the offensive clearly prevailed against any defensive disposition which the German Command had been able to devise. During the first half of 1918 the German preponderance in attacking power and their command of the initiative had saved them from the necessity of developing a better defensive system. But the counter-attack of the Allies on the 18th of July, followed as it was by a continuous offensive pressure over many weeks, brought up the old defensive problem again. The solution first attempted was to maintain the disposition in depth with the support of counter-attack parceled out to relatively small units, and to make the first line of resistance stiffer by making it a chain of machine-gun nests. Where the machine-gun nests could be supported by the flank fire of field artillery, a tendency to return a proportion of the field pieces, though not the heavies, further forward also became manifest.

In all this question of tactics it must not be forgotten that the terrain and the density of the formations play a considerable part. The mud-flats of Flanders, the plains of Picardy, the hill country of the Aisne, and the Vosges Mountains, all are markedly different terrains. The case stated here should be thought of as an average case, or one referring to the place where the most intense struggles have occurred. With this word of warning, it may be pointed out that the most effective retort to the chain of machine-gun nests has proved to be the tank. But we are not discussing the Allied tactics, only German, and it is notorious that the Germans are lagging behind in the matter of tanks. All that need be said, therefore, is that in the latest stages of the fighting, one of the most difficult problems of the German Command has been to offset the breaking down of the

forward line of defense by the combined action of tanks and infantry.

The two sides struggle with one another by a dual process of destruction and of conservation. This duality has from the start been keenly appreciated by the German General Staff, and one of its greatest efforts has been to keep its divisions, particularly those of the 1st class, engaged in battle only to a point at which the losses do not exceed a certain regulated percentage of the division's strength; after this a process of recuperation is set up. The length of this intervening period of rest has gradually decreased since the beginning of the war; and in August, 1918, it threatened for a while to decend to vanishing point. Earlier in the year it stood pretty well established at about six weeks. This was so well understood by the Allies that it came to be tacitly assumed that every German 1st class or attack division withdrawn from battle was exhausted and out of action for six weeks to come. A change of policy in this respect crept in with the Spring and in the offensive of the 15th of July it may have been calculated that by withdrawing divisions long before exhaustion point was reached, they would remain immediately available for attack; while the Allies, thinking along their customary lines, might estimate German reserve strength incorrectly and use up their own too rapidly. A few days later such a pressure was set up by the Allies that the Germans for several weeks were compelled to use their divisions with little respite and immense consequent wastage.

It had, however, already become manifest before this that the German High Command had developed an anxiety as to casualties that went beyond its former balance as between loss and profit, destruction and conservation. Strictly speaking this should be thought of as a psychological result with a negative counter effect on tactics, as is shown by one of Ludendorff's orders.

"It is absolutely necessary that we avoid the mistake of attacking in dense masses. The divisions in line will at all costs try to reduce their losses to the lowest point, distributing their troops in depth and creating an advance terrain of large extent. Too great an importance is attached to the possession of . . . . points of prestige. The divisions in sector will . . . . make greater use of the elastic method of withdrawal. In case the enemy has penetrated our line, it is necessary that the non-commissioned officers of all grades find out whether a counter-attack is really necessary."

No secret was made of the importance attached to economy of man-power; rather the contrary. In an interview with a journalist, Ludendorff was reported to have said with regard to the Champagne offensive: "the enemy having escaped us . . . . we suspended operations. . . . I consider it my most sacred duty to spare the blood and strength of our soldiers." Hindenburg, too, is said to have declared: "The French have been obliged to leave many of

their soldiers before our positions, but we have economized our soldiers. It is due to this fact, and the consideration of supplies, that we determined upon the measures we have taken," (the evacuation of the Marne salient).

The need for economizing man power has resulted, as in previous wars, in a greater reliance on materiel. The recent developments in the proportion of machine-guns, the tendency to call more and more for artillery effects are the universal symptoms of a weakening army.

Another point worth noting is that the German theory back of their employment and recuperation of divisions, had become extraordinarily mechanistic. It is fairly deducible from the facts that during the offensive period of 1918 it amounted to this: Divisions are to be used either for small local operations or for large scale, decisive operations; the intermediate operation is invalid. In other terms: a division or two may be legitimately employed in a purely local operation promising adequate local advantage. Apart from this style of operation, however, every effort must be made to build up large reserve groups of divisions, 20, 40, even 60, as with nothing less than this can decisive blows be struck. The conception therefore prevailed that the result varied directly as the mass, a deduction contrary to all military experience, and that actually worked adversely to the Germans in practice on several occasions that might be mentioned during the campaign of 1918.

It is hardly necessary to develop here the endless variations of the use of artillery in the interplay of preparation and surprise. The Allies themselves had been the first to demonstrate (Cambrai, 1917) that it might on occasion pay to dispense with artillery preparation wholly, for the sake of securing surprise. Between this total non-use and normal use there was evidently a wide range for experiment; and a whole series of variations in the employment of artillery in preparation for the attack is to be found. The tendency in these variations is, however, pretty constant. It is in one way or another to attain the unexpected, that is, to deceive, or to surprise the enemy. This may be done in a variety of ways, as for instance, by gas shells of delayed action under certain atmospheric conditions, and so forth. Another discernable tendency, governed by the greater distribution in depth of the defender, was to shorten the period of preparation.

The aeroplane and the tank, as was to be foreseen, render greater and greater services as the war continues. These will be found for the most part specified under their appropriate headings later; here all that can be attempted is to orient the reader in the larger issues. For detailed tactics, under their specialties, he must now be referred to the second part.

II

INFANTRY

1. TRAINING

For the Offensive:—Winter 1917-18:—German divisions received intensive instruction and training in mobile warfare with "unceasing drill from morning until late at night."

By Feb. 10, 58 Divisions had completed a four weeks' course.

Maneuvers:—Maneuvers were held lasting three days in which several divisions took part. The first day and night were spent marching, the second and third day in "fighting", at the end of which a penetration of 8 kilometers into the "enemy's" line had been accomplished. Tanks and contact airplanes took part and smoke bombs were used.

Practice in Attack:—Some time before the hour of attack the demolition detachments leave the first trenches, place long charges under the wire. At their explosion the assault troops under protection of a barrage pass through the wrecked wire, and on to the enemy's third line, where they send up a rocket as a signal that the objective is reached.

Problems for Combined Arms:—"Training will be carried out from the beginning with the various arms co-operating, and against a skeleton enemy. The destruction of several nests, situated one behind the other, will always be practised."

New Tactics:—"The new training for infantry, which involves fewer skirmish lines, fewer mass attacks, more machine gun attacks in dense groups supported by artillery, rifle fire, light and heavy machine gun fire, use of rifle grenades, trench mortars and accompanying artillery, gives our infantry a marked superiority over the enemy. It has brought us success and has reduced our losses. Our most important aim will be to take these tactics as the basis of training."

Discontinuance of Maneuvers:—"Henceforth there will be few large maneuvers and inspections; the preparations take the men's time, which is necessary for interior duties and tactical excerises."

School of the Squad for Attack:—Preparation of gaps in the wire for assault; assembly in the trenches for assault; leaving the trenches for attack; capture of a portion of hostile trench; penetration of the hostile position; rolling up of a hostile trench; fighting among shell holes; division of the assault detachment into short range and long range throwers and supports; consolidation of a captured position; rapid garrisoning of the position; defense of nests of riflemen who have been cut off; immediate counter-attack. All groups must be trained as assault detachments.

Training of Resting Troops:—With the German reserves so hard pushed as they were in the autumn of 1918, training had to be in part sacrificed.

"The most rapid means of renewing the fighting efficiency of the troops is to grant them sufficient rest and sleep, to look after their physical needs, and to supplement their rations."

"At first very little drill will be held. Games and entertainments will be organized, and wherever it is possible, light agricultural work will be done. I forbid overwork from too numerous and too long drills. Set aside one day of rest each week in addition to Sunday. Grant leaves of absence within the limits of the Army."

2. PREPARATION FOR ATTACK

Organization of a Division for the Offensive:—

Assault detachments—2.
Artillery regiments—increased to 2.
Engineer companies—increased from 2 to 3.

Machine gun companies—6 guns active, 3 in reserve: 120 men, of whom 88 are gunners.

For reconstitution there are two reserves of officers, one with the combat train, another at the training depot in the field.

Reinforcements for the Regiment:—Assault detachments, independent machine gun detachments, pioneer detachments, flame thrower detachments, trench mortar detachments, cyclist detachments, 77 mm. battery, mountain battery (in particular cases).

Battalion Organization:—

4 companies of infantry (3 light machine guns and 3 grenade throwers apiece).

1 trench mortar company.
1 battery accompanying artillery.
1 flame projector section.
1 signal detachment.
1 pioneer section.

In many of the regiments the battalions have been reduced to 3 companies.

Company Organization:—In view of the offensive the infantry company was reorganized into three platoons. Each contain 2 or 3 groups of riflemen forming the *assault* strength and 1 or 2 groups of light machine guns composing the *fire strength.*

In certain cases a fourth platoon was temporarily formed, consisting of runners, signallers and carriers.

Increase in Armament to Meet Losses in Men:—In May the companies of the 3rd Erstatz Res. Regt. received their 5th and 6th light machine guns. To man them it was necessary to break up the third platoons. Each of the remaining two had:

1 infantry squad.
2 squads of grenade throwers.
1 squad of liaison men.
3 light machine gun squads.

An automatic pistol section of one non-commissioned officer and four men, each equipped with two pistols, is to be established in each infantry company.

Approach March:—Before the attack, divisions are usually distributed in depth in groups of two or three, a Corps Staff commanding each group. The bulk of those that are to participate in an offensive are brought forward just beforehand, by night marches and easy stages, from points well behind the front.

Picardy Offensive—The first line assault divisions came up the night before the attack. The second line support divisions started their march so as to arrive at determined points by the zero hour. The third line reserve divisions began marching forward from the rear areas only when the attack was known to be well under way.

Concealment:—Strict silence in passing through villages. Gatherings of men in the open prohibited. No bivouac fires. Traveling kitchens not used.

At the approach of hostile aviators the troops immediately halt and take shelter. The men lie down. Sometimes the infantry is ordered to march in two columns on either side of the roads.

Assembly Points:—Intermediate assembly points are located on slopes protected from fire about 2 km. from the front and adjacent to roads. Shallow pits are dug the night before, which are used, together with shell holes, as shelters for the troops waiting to attack.

Football Attack Tactics:—The Kemmel operation well illustrates their use. The assualt divisions passed from areas well to the rear right through the sector or line divisions at the hour of attack. The C.O.P. was thus avoided.

Units in Adjacent Sectors:—To support the attack, either units or detachments from sectors near the front of attack are shifted over.

3. THE ATTACK

Atmospheric Conditions:—Advantage is often seized of the heavy morning mists to enable "the assault troops to get close up to the wire unobserved, to cut it by hand under cover of the bombardment, and to penetrate into portions of our positions without it being possible to report the exact extent of their advance."

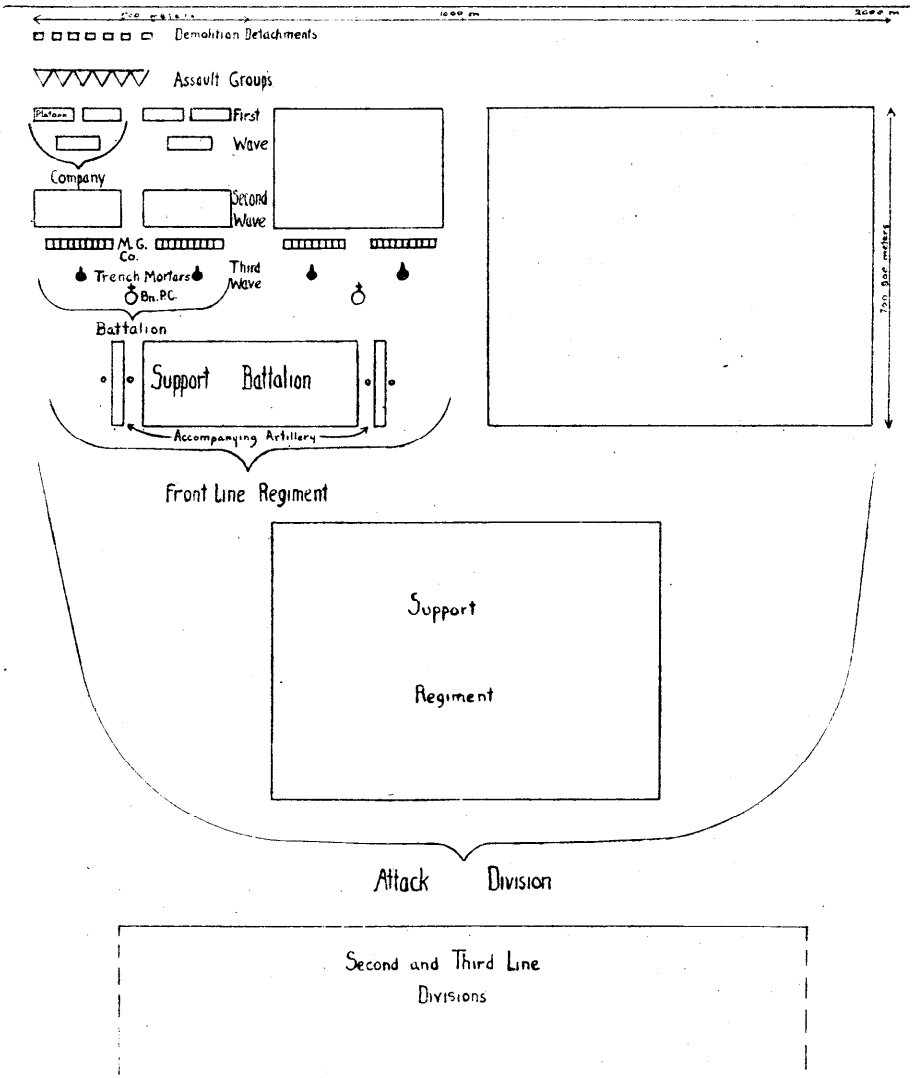
Attack in the Zone of Organized Defenses:—"The attack should be launched immediately on top of the preliminary bombardment. Keep close up to the barrage. Overrun the first hostile positions quickly. During the course of the attack do not give the enemy any time to reorganize. The infantry must push boldly forward under cover of their own auxiliary weapons. Do not wait for orders."

Distribution of Penetration. (Picardy Offensive):—The attack was on a wide front, but was driven in with special strength on certain selected points. Pockets were made outflanking the sectors to right and left.

"The enemy was able especially to penetrate along valleys."

Infiltration:—Infiltration is the basis of the advance, fullest employment being made of ravines, sunken roads, woods and cultivated fields.

By infiltration with a great numerical superiority the enemy was able to surround the strong points, and either force the defenders to retreat or cut them off.



DISPOSITIONS FOR ATTACK

Dispositions:—The leading elements formed into two assault waves, are deployed at wide intervals and advance without regard for the centers of resistance, the reduction of which is the mission of the elements in support. The companies in support follow in small columns grouped into platoons, half platoons and squads. The heavy machine guns follow 300 meters behind the support companies.

Formations:—In the departure positions the first and second battalions of the assault regiment are in the first line trenches, the third in the second line trenches. The three battalions leave the trenches simultaneously, in order that the zone of the enemy barrage may be crossed in as short a time as possible. In fact, it is the practice for the reserves to follow closely, the better to escape the enemy's fire and repulse counter-attacks.

The troops leave the departure positions in columns of platoons, the first two reinforced by selections from the third. The third is the company reserve. In deployment each man rapidly gains his interval of about six paces. There is a distance of 50 meters between the waves.

In a large offensive, infantry divisions hold a front of about 2 km. For the attack, each places two regiments in line; the third is the reserve regiment. The regiment has two battalions in line, with the third in close support. The battalion has two companies on its front, the other two just behind. Companies are in columns of platoons. Machine gun companies march in two lines in rear of the companies of their respective battalions. Light trench mortars follow the machine gun companies. The following chart illustrates these distributions.

Principal variants of the above are:

1. Division: 3 regiments in line, in columns of battalions.
2. Battalion: 3 companies in line and 1 in support.
3. Company: 2 platoons in line and 1 in support.

"*Do not attack in dense formations.* Numbers will not decide, but the use of the auxiliary weapons at the right moment."

The advance is conducted with a "very thin first wave to ascertain where the enemy is still holding out. Behind these are light machine gun groups reinforced by riflemen; these groups advance in rushes. Do not all rush at the same time; there must be mutual fire support When the enemy is located smother him with rifle and machine gun fire so that he cannot make deliberate use of his weapons.

Over open terrain the light machine guns precede, over covered terrain the riflemen.

Squads in Echelon:—With a view to avoiding a repetiton of the heavy losses suffered in the March offensive, an attack formation was practised in which, "instead of continuous waves of assualt, the squads were echeloned and placed unmasking each other at about 60 meters distance and interval."

"The leader holds his troops vigorously in hand by means of previously selected assembly points in advance."

Rate of Advance:—200 meters in four minutes, synchronized with the rolling barrage.

Distribution:—"The distribution of the infantry and artillery for the offensive will be flexible and not bound to the terrain."

Infantry Control over Artillery:—"If the first assault of the enemy's line is successful, the regiments will fight their way forward. For this purpose it is necessary that, in addition to their accompanying batteries, they should have immediate control over their artillery, both light and heavy

Infantry-Artillery Co-operation:—"Both the infantry and the artillery believe with satisfaction that their success was owing to the co-operation which they have at last established. This accord is to be cultivated and strengthened."

Elements of Success:—"The aggressiveness of the infantry, its capacity for marching, and its endurance and spirit of sacrifice, mainly on the part of the officers, have again made possible the great successes achieved. A rapid thrust by only one battalion or company commander may succeed in throwing the enemy into confusion on a wide front, or it may prevent his reorganizing his troops."

Attack against Machine-Gun Nests:—Even after the heaviest bombardment a few machine guns will remain in action. These will have to be dealt with by the infantry. The artillery cannot follow up quickly in this crater area.

Attack against Concrete Dugouts:—The correct method of capturing concrete dugouts which offer holding-on points for the enemy machine guns is to attack them from the flanks while the entrances are kept under rifle and machine-gun fire.

Objectives:—"Only an attack which is pushed home achieves big results. For this reason limited objectives are not to be set and timid attention to the actions of neighboring troops must be avoided."

Depth of Objective:—"Even in the case of minor operations the offensive must be carried eight kilometers or more through a hostile defensive system and across numerous obstacles up to and past the enemy artillery."

Special Objective Maps:—Objectives are marked and circled in blue on maps carried by battalion staffs during the advance. As soon as a blued point is reached by the battalion commander he signals back to balloons or ground observers, who report it to the headquarters.

Reserves:—"Put in reserves where the enemy is giving way, not at the point where he is holding out. Break through and roll up from the flanks."

It is the mission of the reserves to provide from the rear for the protection of the flanks of the units in front.

Endurance:—"The infantry must, by skillful tactical leading, preserve its fighting strength so that divisions are capable of carrying out offensive battles of several days' duration and entailing considerable advance" without relief.

4. THE BATTLE IN THE INTERMEDIATE ZONE

General:—"When, during the course of recent combats, an attack stopped, it almost always occured in a battle in the intermediate zone. The chief cause was the fact that the troops were not thoroughly familiar with its tactics."

The battle in the intermediate zone begins when the advance has reached a point beyond which neither the preparatory bombardment has been effective nor the rolling barrage can extend its protection.

The tactical missions of the infantry are:

1. Reduction of machine-gun nests and points of support, by the fire of which it finds itself suddenly faced or flanked;
2. Repulse of violent counter-attacks;
3. Destruction of tanks;
4. Penetration at points where the advance is easy;
5. Protection of flanks. (The task of the troops in support.)

Mixed Units:—As the infantry is only rarely capable of carrying out its missions by its own weapons, accompanying artillery and a section of light trench mortars are placed under the orders of each battalion, which thereby becomes a mixed body of infantry, artillery, trench mortars and machine guns. This "permits the battalion commander to fulfill the duties which fall to his lot without outside aid."

In many cases the regiment is likewise transformed for the attack into a mixed body by placing an artillery group (additional to the batteries allotted direct to battalions) some engineers, assault detachments, independent machine-gun detachments, cyclists, etc., under the orders of its commander.

Use the Rifle!:—The men do not seem to wish to or do not know how to use their rifles. Assistance was demanded of the machine guns and artillery in cases where the infantry could have managed without them.

"For firing . . . while moving, an attempt at aiming is required." March, therefore, with the rifle ready. It should never "be fired from the hip." "It may be left to the judgment of the rifleman, according to their personal skill, whether they should actually fire while moving or make a short halt, aim and fire."

The Advance (Picardy Offensive):—The successive attacks were echeloned. Forces were massed on various points and made a rapid attack. If a local withdrawal resulted, the advance proceeded through the intervals and threatened the flanks of neighboring units. Attacking troops generally advanced by passing through their own lines.

Reduction of Machine-Gun Nests and Points of Support:—"The neutralization of the majority of hostile machine guns will have to be carried out after the assault.

"No uniform method of dealing with machine guns—arranged for mutual support—can be laid down, but it is essential that all arms should co-operate for their destruction," employing all means and making an intelligent use of ground.

Whenever a point of support and machine-gun nest is approached, it must first be determined whether it is possible to pass beyond them without attacking. If the reduction is indispensable, the infantry will first of all attempt it with its own weapons.

The infantry deploys in a thin line of skirmishers, lies down, and, accompanied by light machine guns, it seeks to gain contact by bounds with quite weak groups, approaching as near as possible. The light and heavy machine guns try to immobilize the enemy with their fire, while under this protection larger forces are engaged, which close in on all sides. In the meantime the accompanying guns and trench mortars are brought into position and open fire.

"Good communication between the gunners and the infantry commander who selects the target" is absolutely necessary.

The method of attacking strong points from the flank and rear while merely holding them in fire from the front is conspicuous in German operations.

Outflanking Points of Support:—The infantry must keep at a sufficient distance from unreduced points of support, so that it cannot be effectively fired upon by their machine guns, or else it escapes the fire under protection of the dead angle. When neither is possible, the side of the point of support towards the infantry must be neutralized by fire.

Flanks:—If weakness of the enemy allows a rapid advance at some point the situation is exploited without regard to the flanks. "The troops may at any time temporarily leave their battle sector, but they will return to it as soon as their mission is accomplished. The general direction will not be lost sight of."

"It was possible during the first days of the (Aisne) offensive to disregard the question of flanks. Here we succeeded in penetrating deeply at a point on the front and neighboring units quickly came up to the same alignment. When the resistance was more determined, it was necessary to proceed more cautiously."

Reserves:—In open warfare we seek to gain a decision by outflanking the exposed wing. In the battle to break through we strive for the same result by bringing in the reserves at the points where the advance has been most rapid, and thus reaching the rear of the enemy, succeed in outflanking him.

Formations: Open Country:—In open country "the leading elements will advance, preferably in line of sections or at least in line of squads, to avoid scattering."

Posts of Command:—"The position of the commander is of considerable importance. All staffs must be on the battlefield, including corps staffs, the divisional staffs being pushed well forward."

Organizing the Objective:—"Having attained the objective and prepared to defend it; throw out a line of sentries in advance; establish communications; distribute in depth; send back sketches; prepare for the arrival of the infantry planes."

The New Line is organized and fortified. Echelons in depth are promptly established and liaison with the infantry planes effected by means of rockets, Bengal lights, and signal panels.

5. STABILIZATION

"It is the task of the command to anticipate the moment when the action of the enemy's reserves will become more pronounced. The attacks must then be gradually carried on in a more methodical manner; heavy artillery preparation with an increase of expenditure of ammunition will be required more and more up to the moment when it appears that the operation should pass into the defensive stage. When the enemy's reaction and counter-attacks are made without sufficient preparation, he will suffer heavy losses in the face of a skillfully conducted defensive, while our own forces will be economized. It is almost never a question of our gaining ground at any price. We must destroy the enemy but economize our forces.

From this point of view we must have a clearer military perception; we have still had a tendency during recent fighting to attack with too feeble forces and to fight for gains in ground which were of no importance to the general situation."

6. MACHINE GUNS

Importance of the Machine Gun:—"The machine gun is the principal infantry weapon and forms the skeleton of its combat formations. The technical and tactical principles of its employment must become second nature to the soldier."

Training Schools:—One at the Senne Camp in Westphalia, which gives a six weeks' course in heavy machine guns. The 2400 students, divided into four companies, are instructed in target, grazing, sweeping indirect, and anti-aircraft fire. Each company is equipped with 16-20 guns. Another at Doeberitz, at which 1000 machine-gun officer candidates at a time, divided into six companies, are given a three months' course to fit them for commissions.

Training of Machine-Gun Companies:—They participate in the battle training of the infantry to insure co-operation in the attack. They are particularly instructed in:

Frequent firing in gas masks and steel helmets;
Action against airmen and tanks;
Night firing;
Following up the attack in support;
Protecting the infantry while deploying;

Occupation of no man's land after a successful attack, to ward off immediate counter-attacks which have broken through;

Filling belts in action;
Support of the attack from high ground on one flank;
Supply of ammunition;
Bringing up the carts;
Fire control;
Fire discipline;
Command.

Regulation Allotment:—

Infantry company—6 light guns.
Infantry regiments—72 light guns, 36 heavy guns.
Artillery battalions—6 heavy guns.
Cavalry—3 heavy guns.
Landstrum m. g. companies— heavy guns.
Recruit depot—12 light guns, 6 heavy guns.

The Light Machine Gun:—It is a principle of the Germans that the light machine gun is not an auxiliary weapon but as important a means of combat of the infantry as the rifle. It is carried well forward on the very crest of the advance, and even in open country it often precedes the rifle groups.

Importance of the Light Gun:—"I again emphasize that the light machine gun is the infantry weapon and that the company of infantry has become, so to speak, a company of light machine guns. Its main fire strength, in he attack as well as in the defense, rests in the light machine gun, which

corresponds to the power of 30 rifles and even more. The remaining infantry is to be used mainly for sentry duty, patrols and communications, the formation of assault detachments, and other infantry service."

Composition of a Light Gun Group:—

1 chief.
1 gunner.
1 loader.
2 carriers.
4 reserve carriers.

Use of Light Guns:—(A) In the attack, in order to force the enemy to keep under cover during the advance of the infantry and to reduce or neutralize hostile machine-gun nests or points of support; (B) in the defense, in order to stop counter-attacks and protect the flanks of the first line.

Distribution of Light Guns for the Offensive:—The advance of light machine guns serving as "feelers" for the infantry has prevented losses to the latter, but machine guns should be preceded by scouts. An advantageous position for the light machine guns is on the flanks of the companies, as they can thus move forward alternately without interrupting the company's fire. The company commander keeps a reserve machine gun with him in order to overcome any unforeseen hindrances (an obstacle appearing on the flanks, a hostile counter-attack, etc.).

Methods of Fire—Light Guns:—A prolonged and continuous fire is not possible with light machine guns. They will only be used on important objectives, with brief and well regulated bursts of fire, and the task of firing on individuals will be left to the infantry. They will only be used at short range. Fire beyond a range of over 600 meters is a waste of ammunition. The light machine gun does not lend itself readily to fire executed from a dominating position over the heads of friendly infantry.

Employment of Light Gun Groups in Attack:—"The light machine gun groups (each of one N.C.O. and eight men, with one light machine gun), which are to be equipped for independent action (rifles, pistols, hand grenades, entrenching tools), form, owing to their great mobility and concentrated fire power, the framework of the infantry attack. They can carry on the fire fight, if necessary, without any groups of riflemen. There should be two of these machine gun groups in each infantry platoon, so that they may mutually support each other by fire.

"From the jumping-off trenches, the machine gun groups push as far forward as they can (if possible, before the end of the artillery and trench mortar preparatory bombardment) as 'offensive points' ('offensive nests'). Their task is to secure the advance of their own infantry within the sectors allotted to them, by keeping down the fire of the enemy's front line and of any hostile machine guns which may remain intact. The fire of the advanced light machine guns will be opened suddenly, directly the artillery and trench mortar preparatory bombardment ceases; it will cease when the first wave penetrates into the enemy's position. These machine gun groups then follow the first wave.

"Other machine gun groups form part of this wave. Their place is with the platoon commanders. During the advance, they open fire at close range; they take part in rolling up the enemy's trenches, and form the main fire power of the platoons which push right through as far as the initial objective of the assault. Here the machine gun groups will at once

dig themselves in, will cover the reorganization of the attacking troops and will pursue the retreating enemy with fire. If bunching occurs in the line the machine gun groups which are following up will fill the resulting gaps either by occupying them or by fire. If the advanced machine gun groups encounter resistance, they will take up the fire fight, keep down the enemy's fire by their own fire, and thus enable the groups of riflemen and the machine gun groups following them up to reach the enemy."

Use of Ground:—The light infantry machine gunners appear to have been well trained in the use of ground. This is an essential point, since it enables them to build up a firing line in which not only comparatively few troops are employed, but of which little or nothing can be seen and located.

Distribution and Missions of Heavy Machine Guns:—"The placing of the heavy machine guns in two-gun sections outside the infantry line is the normal arrangement and one which has given excellent results. Two sections follow the last waves of the first line companies. Their mission is firstly, to provide flank protection, and secondly, to break the enemy's resistance and to check counter-attacks. When the infantry encounters stubborn resistance one section is sent forward, thus permitting the infantry to advance at the points of least resistance. These two sections will go forward alternately, supporting each other by their fire and seeking dominating positions wherever possible.

One section remains with the battalion commander. Its main duty is to combat infantry airplanes; it will be sent wherever needed.

When the terrain is level and devoid of cover, the first lines of infantry may require the support of heavy machine guns in advancing. The placing of heavy machine guns in the first line, however, will only occur under exceptional conditions, as, for example, in case the infantry has been weakened and needs a great fire strength in the first line and in case the light machine guns have been put out of action. This arrangement, furthermore, must be only temporary. It is insisted that the normal fire will be executed by the infantry. The heavy machine guns only intervene when it is a question of obtaining fire superiority for a well-defined purpose.

Employment of Heavy Guns in Attack:—"In the co-operation of the various arms on the battlefields, the heavy machine guns form the connecting link with the trench mortars and field guns. By virtue of their mobility they must come into action in support of the attack, especially at points where, owing to the rapidity of the advance, the heavier weapons have not been able to co-operate.

When the enemy's line has been penetrated, and the task of the attacker is not merely the capture of hostile trenches but is a question of making a further advance, the heavy machine guns are free to carry out fresh tasks. Pushing forward, section by section, they follow the infantry waves, making full use of the ground and avoiding the enemy's artillery fire. Their objectives are points from which overhead and flanking fire can be brought to bear. Their task while the attack progresses is to undertake the protection of the infantry and light machine guns, wherever an opportunity for effective action is presented.

The heavy machine guns advance by sections and alternately. One section must always be in action ready to open fire.

Equipment of Heavy Gun Companies:—On the offensive the heavy machine gun companies are engaged with 9 instead of 12 guns, 6 active

and 3 reserve. The personnel thereby released is devoted to the supply of ammunition. The gunners are armed with the carbine or pistol.

Picked Machine Gun Detachments:—At the beginning of the Picardy Offensive there were 80. "For the offensive, 56 were distributed among the attacking divisions, while 24 remained at the disposal of G. H. Q. for use in quiet sectors in case of Allied attacks."

Their use has been varied. Sometimes these detachments acted with the three companies together, sometimes each company acted separately. Some sections were attached to batteries accompanying the infantry. The detachments which maintained their companies grouped together had the special mission of assuring the occupation of the support zones and the points of contact between divisions, to establish themselves on dominating or flanking positions, in order to carry out preparatory fire.

Mountain Machine Gun Detachments have been principally used as a divisional reserve for the protection of the flanks. One detachment in position upon some hills supported the infantry in crossing the Somme; they were also employed for neutralization and preparatory fire before the Picardy attack.

Indirect Fire:—The peculiar characteristics of indirect fire require some time for its preparation and execution, depending on the skill of the commander and the ability of the men. The regulation aiming apparatus must never be dispensed with, for it only results in a useless expenditure of ammunition. Indirect fire belongs chiefly to the defensive or to the attack preparation, which gives more opportunity for the fulfillment of its required preliminary conditions than the offensive advance.

Anti-Aircraft:—The course of training for fire against airplanes comprised:

1. Study of airplane silhouettes.
2. Judging distances with the naked eye.
3. Firing the guns without the circular foresight.

During marches to the front, one or two guns are detailed by each machine gun company for the protection of the regimental train en route, and the park and bivouac at night.

Machine Gun Personnel:—Only robust men should be selected; the weak become quickly worn out. The training, especially of new replacements, is often insufficient.

The losses are twice as heavy as among the infantrymen. This has been the result of too large crews. 5 men and the chief are sufficient. The supernumeraries will care for supply.

The equipment must be lightened. Only the reserves carry packs. The others have only their assault equipment.

Transportation:—Guns carried by men, ammunition by pack horses.

Distribution in Defensive Battle:—The average density is 1 gun to every 40 meters of front. A large freedom for initiative seems to be left to company commanders in siting the light guns, and to battalion commanders for the heavy guns. The only common feature in the different distributions is the presence of light guns in the first line or immediately behind it.

Location of Machine Guns for Defense:—The support position is unsuitable for the location of machine guns. The enemy artillery can direct

its fire on them there, while its infantry is breaking into the front line. For the defense of the front line, the guns should be in the front line itself; else they should be back in the reserve zone.

Machine Gun Nests:—They should be located so as to be able to enfilade flank attacks on strong points. Each is surrounded by entanglements and comprises:

1. Firing position.
2. Well-protected emplacements for the personnel and ammunition.

7. SPECIAL SERVICES AND SUPPLY

Action of Infantry in Conjunction with Tanks:—For the infantry the tanks fulfill the same functions as accompanying batteries. In an attack on close objectives the infantry and tanks advance side by side in close liaison. It is of decisive importance for the success of the attack that prompt advantage be taken of the effects produced by them. For more distant objectives, in which case the speed of the tanks does not permit them to keep up, the infantry must not wait for them.

Tanks:—Tank tactics never attained any importance in the German scheme of operations. The tanks produced in Germany proved unsatisfactory and their manufacture was discontinued in July. A General Staff Memorandum dated May 19th, states their mission to be the neutralization of machine gun nests and other centers of resistance, especially those in flanking positions, and co-operation in counter-attacks by pushing in wherever they could, seeking breaches in the enemy's line to get through and take it in the rear. When a tank was disabled, its crew were to dismount and form either a machine gun nest or an assault detachment. Orders of the 238th Division and the accompanying tank detachment for the attack east of Rheims on June 1st prescribe definite routes and objectives for the tanks, but purposely omit any special instructions for co-operation with the infantry beyond assigning a small accompanying detachment of assault troops. A signalling and liaison center was fixed through which co-operation could be secured according to the circumstances of the battle. The German tank establishment, never large and always relying mainly on captured machines, has not even been kept up. The need for accompanying artillery has been left to be met by the infantry gun, which offers an indifferent solution of the problem, having less mobility and greater vulnerability than the tank.

Special Assault Troops:—Assault battalions serve principally as schools of instruction for officers and non-commissioned officers. The latter are given a four weeks' course in assault tactics, machine guns, trench and field artillery. In the majority, the student officers merely attend the exercises of the assault battalions as spectators but sometimes they are distributed among the assault detachments and practice with them.

This year there has been more general use of assault battalions or detachments in operations. In all the offensives, assault companies assigned to attack divisions have constituted the vanguard of attack and driven the first breach in the defender's line.

For the offensive, assault detachments receive special training, and equipment. The following is a specimen program of training:

1. Suppleness drills.
2. Grenade throwing.

3. Attack—long charges, destroying dugouts—approach to hostile positions and strong points.

4. Repulse of assault.

5. Counter-attacks.

6. Anti-tank combat with armor piercing bullets.

The equipment in the Picardy Offensive consisted of: wire cutters, 8 stick and 10 egg grenades, and 100 extra rounds of S. A. A. The men carried no packs.

"Each assault detachment will have a complement of grenade dischargers in batteries of from two to four."

Flame Projector Units:—Strength—1 officer, 9 non-commissioned officers, 34 men, including 1 runner.

March formation—Column of Squads.

Detachment commander.

4 non-commissioned officers, squad leaders;

4 nozzle carriers;

4 Wix carriers;

4 Wix carriers;

1 runner, 3 non-commissioned officers;

2 substitutes, 1 machine gunner, 1 nozzle carrier;

2 substitutes, 1 machine gunner, 1 Wix carrier;

2 substitutes, 1 machine gunner, 1 Wix carrier;

2 substitutes, 1 machine gunner, 1 carrier;

1 non-commissioned officer, 1 substitute, 1 non-commissioned officer.

Employment:—"The flame projectors precede the assault troops. If the enemy resists, the men carrying the projectors halt and lie down, and the attack detachment advances and makes use of its grenades;" the two groups act alternately.

They are useful in combats against villages. "They must fight in close liaison with the infantry, which helps them with the fire of its machine guns and grenades.

Pioneers—Training:—Before the offensive of June 9, certain divisions had drilled their pioneers during the period of training in the construction of foot bridges, either on stakes or cylindrical metallic floats.

Pioneers—Strength:—The allotment of two companies per division is insufficient. At present the assignment to the infantry of the division varies from one to four sections.

Pioneers—Equipment:—After the 6th machine gun company has been distributed to infantry companies, the pioneer companies will each be allotted two.

Organization of Supply for Offensive:—"The close combat column is attached entirely to the division. It is divided into two columns, each composed of five groups. It consists of engineer, bridge and well material, close combat weapons and ammunition for the light and medium trench mortars."

"During the course of the marches of a division to take its place in line during an offensive, it will be necessary for each detachment of troops to have its own combat train, which, however, will be limited as much as possible." In general, they will consist only of the field kitchens and light machine gun carts.

As a rule, "the infantry and machine guns will carry with them one day's supply of ammunition; or, for each light machine gun, 2,000 rounds, for each heavy machine gun, 4,000 rounds on belts; a total of 30,000 rounds for the light machine guns and 60,000 rounds of armor piercing ammunition for the heavy machine guns."

"Before an engagement the amount of baggage (office equipment, records, personal baggage, etc.) will be further diminished. The Division will establish a depot in the rear for its superfluous baggage."

All columns returning from firing positions to ammunition depots will bring back with them empty shell cases and packing material. These columns will likewise bring back the wounded.

Supplies by Air:—Infantry planes supply surrounded troops by dropping baskets attached to parachutes. The capacity of each basket is one day's rations for 30 men, or 980 cartridges, or 40 grenades. Supplies are requested by panels.

Food (Picardy Offensive);—The first two days the reserve rations were eaten. After that the supply was fairly regular.

Requisitions in Occupied Territory;—Requisitions to satisfy temporary needs only may be made by units in the field. They must be limited to the billeting area of the unit by whom made. All other requisitions and collection of materials are controlled by an organized supply service. Through it the most efficient and thorough procurement and utilization of the resources of an occupied territory is made.

8. LIAISON

Importance in Battle:—"It is necessary to have a firm command without destroying the initiative of the troops making an advance. With this in view, a greater importance will be attached to the preparation of the means of communication for the transmission of information, to the method of forwarding information and to the manner of combined advance. The time which orders and reports take to reach destination will be taken into consideration. A rapid comprehension of the entire situation, even in the smaller units, has a deciding influence upon the success of the operations."

Message Centers:—Orders for attack will indicate to the troops by means of maps and airplane photographs the message centers which are to be established during the battle, so that each unit will know where it can find means of communication and where it may establish contact by telephone.

Telephone:—The divisional telephone detachment will first construct the lines between the division and brigade and in advance of them—i. e., the two sections of line which connect them with the head of the line—which must be carried forward as the attack progresses. The Signal Corps officers attached to the regiments connect their respective headquarters with the head of the line by employing the regimental telephone squads reinforced by the construction squads of the Divisional Telephone Detachment.

The installation of lines between the various message centers is commenced behind the second wave of infantry. Message centers should be established before the headquarters are installed, so that they will be ready to function from the moment a headquarters arrives at its new command post.

Radio Telegraphy:—"In principle it will be used only when there is no telephone, and only important tactical messages, reduced to the most concise code form, will be transmitted." Along the narrow front of an attack division only a single line of radio stations is to be provided; a small post with light infantry aerial for the division; a G apparatus with the brigade and an M apparatus for the message center (with the brigade, if the advance makes it necessary); and an M apparatus at the terminus of the line of communication, which at the same time is near the first line infantry regiment.

Ground Telegraphy:—"An effort will be made to . . . use it in front of the regiment. In some cases it renders good service during the advance."

Signal Lanterns:—Signal lanterns are particularly useful during a rapid advance because of their portability. The signalmen must be trained in infantry duties, in addition to their own, and particularly to take advantage of the ground.

Chains of Signallers:—Chains of light signallers are the best means, provided the weather is fairly clear, of transmitting rapidly the requests of the infantry to the artillery in open warfare, particularly in forest land. They should extend as far as the front line, the intervals between their positions being short enough to insure the transmission of signals even through fog, dust and smoke.

To avoid errors, luminous signals will not be received from a lateral direction. Only those coming from the front will be received and transmitted to the rear.

Carrier Pigeons:—Carrier pigeons will be of service to the command when telephone communications cannot be maintained between the line of battle and the division. They are distributed to the artillery observers, the observation posts in the front line, and frequently to the balloon sections

Messenger Dogs:—They will, as a rule, be employed between two fixed stations. During the first part of the attack, they will be thus employed to connect a sentry with the non-commissioned officer's post and with the outpost.

Runners:—They are used chiefly between battalions and the regiment. The relay of runners passes along the telephone lines, which they watch for breaks at the same time they are carrying messages.

Liaison by Air:—There are times in the course of the fighting when only the aviator can rapidly bring news of the situation to headquarters. For this reason, it is necessary that the infantry be abundantly provided with rockets, illuminating pots, and signal strips. It is important that the brigade and divisional command posts which change their positions frequently, be indicated by means of illuminating pots or by white strips of cloth, four square meters in size, with the characteristic signs indicating the brigade or division. The habit of displaying panels must be developed to the point where it is instinctive during combat.

Listening-in Posts:—They are established as quickly as possible after a halt in the advance.

9. ARMAMENT

In general, no new weapons or kinds of ammunition were introduced in any of the German offensives. A number of changes in their allotment

and distribution were instituted. While mobile warfare required that the burden of the men be lightened, and the means of transport be curtailed, it was also essential that troops have a large degree of independence of lines of supply and that, nevertheless, ammunition be continually on hand.

The infantry armament was lightened chiefly by discarding those weapons that are not portable or are superfluous in trench warfare. No automatic rifles are used, and grenade throwers are generally left behind, though it was proposed to re-equip the infantry with the latter for use against machine gun nests. Of the battalion allotment of four light trench mortars, only two generally follow the advance. The others remain with the regimental combat train.

Allotment of Armament:—Careful discrimination must be exercised as to what is taken and what left behind. The assault detachments must have a number of grenades; the sharpshooters, much ammunition; the section leaders, many flares; the carriers, tools, ammunition and sandbags.

Equipment of the Infantryman:—It appears that in the attack on March 21st, it was as shown below. The men apparently threw away much of this equipment in the early stages of the advance.

Rifle and bayonet
2 hand grenades
2 field dressings
1 signal cloth (for signalling to airplanes)
Pack (with great coat strapped around it) containing:
- Canteen
- 3 days' rations (1 iron, 2 ordinary)
- Linen
- 1 pair ankle boots
- Field cap
- Rifle cleaning accessories
- Waterproof sheet
- 2 water bottles (generally containing coffee)
- 150 or 200 rounds of S. A. A.
- Entrenching tool.

Gas mask in the alert position and spare drum.

Light Machine Guns:—For the offensive 6 per company were authorized, but during the spring this figure was reached only in exceptional cases. The number has been steadily increasing and has recently gone above it, even up to 12. In the advance, 2 are assigned to each platoon in the assault wave, and one or two are in reserve.

Rifle Grenades:—On the offensive, the enemy may be reached with the rifle grenade before he is within range of the hand grenades (150 yards). Infantry well trained in rifle grenade firing lends itself more readily than any other to the support of the artillery and light trench mortars. The rifle grenade is also of great importance in cleaning up trenches.

Little use has been made of rifle grenades on the offensive.

10. OCCUPATION OF THE SECTOR

Principles of Defense:—"An offensive attitude of the artillery and infantry; elasticity; distribution in depth; and no attempt to contest every inch of ground."

Repulse of Local Attacks:—"It is the duty of the army corps to resist the enemy's local attacks with their own forces. In the plan of the High Command as a whole this heavy task has the same importance as an attack on a large scale; it alone will permit such an offensive."

Lines of Defense:—

1. The outpost zone.
2. The main line of resistance.
3. The support position.
4. The second line of resistance.
5. The artillery protective position.

Organization of the Sector Command:—All the infantry, including close combat units, is placed under the command of the C. O. of the infantry brigade. The 3 regimental sectors are under the orders of the respective regimental commanders.

Advance Battalions:—In each of the regimental sectors 3 companies are placed as an advance garrison; 2 companies furnish the sentinels and outposts, 1 company remains as a counter-attack reserve. The 4 companies of the advance battalions of the second and third regimental sectors are retained as divisional reserves and the fourth company of the first regimental sector as a brigade reserve. They are placed near the P. C.'s of their respective regiments.

Combat Battalions:—In each regimental sector there is a combat battalion with two or three companies in advance and one or two companies as a counter-attack reserve.

Support Battalions:—One from each regiment. Two companies of each act as a sector organization in the line of artillery protection. The other two companies from each support battalion in the first and second regimental sectors are placed in the immediate neighborhood of this line.

Combat Liaison Detachments:—They assure the protection between two units. One or two companies, each with a machine gun section, and with one field battery between them, are stationed at the left of the division for this duty. Between regiments one company of the right hand regiment provides combat liaison.

Control of No-Man's Land:—Our patrols must dominate the ground in front of the outpost zone. Prussian infantry superiority must always manifest itself, even during quiet periods; prisoners must be taken.

The Outpost Zone:—In a large attack a deep advanced zone prevents the enemy from destroying with his artillery fire great numbers of our garrisons and thereby penetrating our front. In local attacks, however, the troops must not withdraw from it without serious fighting. If momentarily abandoned, it will be retaken immediately.

Location of Outposts:—Outposts must have a clear view of the surrounding terrain. In woods they must make sure of flank observation in order to have a suitable field of fire and sufficient protection.

In order to prevent the enemy from systematically launching surprise attacks against outposts which he has studied accurately by airplane photographs, the garrisons of the outpost zone change their position frequently and sentries do not remain stationary but patrol a definite post.

The emplacements of outposts and their alternative positions are surrounded by wire entanglements in order to prevent the enemy from surprising the outpost garrison.

Machine Gun Fire:—Preceding the times when the enemy is accustomed to make his raids, machine guns sweep the advanced terrain, and at irregular intervals carry out indirect fire on points which the enemy might use for concealing his approach, such as depressions in the ground, roads and villages.

Evacuation of the Outpost Zone:—"It is not possible to establish a fixed rule for the best moment for the vacation of the outpost zone by the garrison and for their withdrawal either to the main line of resistance or to the line of resistance of the outpost zone. That depends on local conditions and the strength of the assailant."

"One must never think of vacating the outpost zone permanently during the night or during the hours of obscurity, for it would permit the enemy to establish himself there without fighting. . . . Vacation of the outpost zone will only be temporary at any time; as soon as the enemy's attack has been repulsed the vacated ground will be reoccupied as before. It cannot be otherwise, for it would be necessary, after every combat, to withdraw the main line of resistance in order to create a new combat zone."

When attacked the garrison will retire fighting to the principal line of resistance. Support from the rear must not be counted on. When it is known that the enemy is going to attack, the division may order the methodical evacuation of the outpost zone.

Resting battalions will be drilled to withdraw skillfully and to defend the outpost zone with elasticity.

The *zone of extreme resistance* is the forward limit of the battle zone. It is organized into points of support in which we fight to the end, engaging all our forces except the sector garrisons of the withdrawal positions. It is the duty of all commanders under an extremely violent enemy bombardment to escape from its effect by moving forward or laterally rather than backward.

Sector Liaisons:—A large variety will guarantee maintenance of communications under fire, though only in relatively short engagements.

Telephones:—Lines should be reduced to the smallest number possible. One from each brigade forward is sufficient. Those between companies and P. C.'s can be overheard by the enemy and are abolished.

Visual Signalling:—Works slowly. Intermediate stations are objectionable. The artillery system must be separate.

Radio Telegraph:—Batteries delivering barrage will have receiving apparatus, but in any case they must have visual communication with the front lines.

Messenger Dogs, Pigeons and Runners are for use between companies and the P. C.'s

The liaison service must be safeguarded by suitable shelters. A "telegraphic style" brief and clear must be cultivated in messages.

Rifle Grenades, Tactical Use in Defense:—

Barrage Fire:—The rifle grenade supplements the barrage fire of the infantry. The rifles fitted with grenade dischargers will be placed beside the bomb throwers along the main line of resistance.

On account of its short range, the rifle grenade cannot bombard the terrain in front of the outpost line. It must confine its action to executing

barrage fire in conjunction with the bomb throwers and heavy machine guns in front of the most threatened point.

The dischargers will be distributed among the groups, especially among the light machine gun groups.

The batteries of rifle grenades must have a distinctly determined barrage sector. Each grenade discharger can bombard an area of from 15 to 20 meters. Set up the rifles in permanent position upon the bipods so that they may be fired immediately. Twenty-five to thirty grenades will be allotted to each discharger.

Harassing Fire:—"As the most effective burst of the rifle grenade is at a distance of 170 to 180 meters, the target will be at that distance."

Tactical Lessons from the Defeat of the IInd Army:—The causes of the defeat were:

1. Surprise created by the mass attack of tanks which suddenly appeared behind our lines, having broken through in a fog.
2. Practical non-existence of any positions or obstacles in or behind the forward battle zone.
3. Insufficiency of the artillery with battalions at rest and reserves to the rear.

Instructions:—More trenches and anti-tank defenses must be constructed. Points of support mutually flanking each other must be established in the rearward zone by creating a strong defensive organization of the villages, farms, woods and roads, with the aid of wire entanglements and by constructing anti-tank defenses.

Defense of Villages in the Rear:—During a large enemy attack sudden incursions by cavalry, armored cars, or tanks may be expected. As such operations generally follow the roads, strongly defended villages offer the best means of checking them. First of all a means of alarm must be provided which can be sounded by outguards who have a wide view of the surrounding country. At its sounding the troops assemble with their arms at a designated point. The village is well-stocked with close-range weapons, ammunition, and signal lights. In case of attack the commanding officer notifies the district commander, the nearest division and post on the line of communications.

Economy of Effectives:—The shortage in effectives makes it imperative that "the divisions in line . . . reduce their losses to the lowest point by distributing their troops in depth and creating in advance terrain of large extent."

"Too great an importance is still attached to the possession of terrain, to holding or retaking trench elements, villages or parts of forests, etc., which are only points of prestige."

Greater use must be made of the elastic method of withdrawal.

"In case the enemy has penetrated our lines, it is necessary that the N. C. O's of all grades find out whether a counter-attack is really necessary." Frequently no gain is obtained, but heavy losses are suffered.

Maintenance of Fire Strength:—The German High Command is attempting to preserve the same degree of fire strength of its divisions by replacing losses in effectives with materiel. For example, the number of light machine guns for the defensive is to be greatly increased, even up to 12 per company.

11. COUNTER-ATTACKS

General:—They should strike the enemy just at the time when his progress is beginning to slow up. At this moment of his weakness a counter-attack is most feasible. The object is not only to definitely check him but to recapture lost guns and ground. Unless otherwise specified, the objective is the defender's original lines.

Counter-Attack Troops:— Each unit retains a part of its strength in support for counter-attack. Where it is necessary to use divisions for counter-attack, they are divided into counter-attack groups of mixed forces. Counter-attack troops must be well forward, else they suffer heavy losses in passing the enemy barrage while coming up. The counter-attack troops advance in waves, with intervals of not less than 1½ paces. All the weapons ordinarily used in the attack are brought into play.

Close Combat:—When engaging, commanders should seek to close in hand-to-hand fighting, at which their fresh troops hold a great advantage over the tired troops of the attacker. Time should never be given to the latter to rest or install himself.

Point of Delivery:—It is best to strike the enemy in movement, on the flanks. The guiding principle is to overwhelm a fatigued enemy by a sudden powerful blow at a time and place least expected.

Losses vs. Gains:—If in attacking to retake the outpost zone a strong hostile resistance is encountered, it will be carefully considered whether the zone at the point in question is worth the trouble of engaging new forces to reconquer it. It is better to avoid heavy losses rather than to determine to retake it at any cost, especially in regions where it is not of capital importance.

12. RAIDS

General:—They are conducted under the general supervision of the Army Assault Battalion, which contributes some of its specialists to the raiding party. The latter is brought up to the strength of a battalion or a battalion and a half by drafts from units in the sector involved. A few days' previous instruction on positions similar to those to be entered is held.

Rehearsals:—The raid on Xivray on June 16th was secretly rehearsed in the rear for five days, the last rehearsal being concealed behind a screen of smoke.

Organization of Raiding Party:—3 detachments, 1: a group formed by the regimental volunteer corps (80-100 men), preceded by 4 squads of pioneers, and flanked by 2 squads of 6 men and 1 N. C. O. each. 2 and 3: Two groups, each with about 170 men and two light machine guns, and preceded by an assault company and about 8 pioneers. A communication detachment follows to establish liaisons. White brassards are worn by all.

The Attack:—The artillery preparation is very brief but violent. If the enemy lines are weakly held, it is sometimes dispensed with, so as not to raise an alarm.

No new tactics have been developed recently. The advance is either in isolated groups, each with bombers, riflemen, pioneers and carriers; or the entire party leaves the lines at the same point in double column of files and does not separate until the entanglements are passed. No par-

ticular pains are taken to maintain liaison between groups which "is insured by the unity of objective."

The Machine Guns sweep the enemy area during the raid to disperse troops forming for a counter-attack.

Pioneers:—Their mission is to blow up entanglements with long charges and dugouts with boxes of Melinite.

Liaisons:—*Wireless:*—A reserve outfit with a range of 5 to 6 km. operated by 1 N. C. O. and 3 men, accompanies the center raiding detachment. It establishes itself with the detachment in the enemy position and transmits back to a receiving set in the 1st line.

Visual Signalling:—2 signallers accompany the center detachment.

Telephones:—4 squads, each of 3 to 4 men, lay a line apiece from their own to the occupied trenches.

More Distant Objectives:—The greater depth of sector defenses and the increased importance of capturing documents are responsible for the growing tendency to select more distant objectives, and consequently to increase the raiding force.

Longer Occupation of Enemy Positions:—The practice of evacuating the front zone at night has imposed upon the raiders the necessity of awaiting the counter-attack, in order to take prisoners. This may mean a sojourn of 48 hours in the enemy's position.

13. DEFENSE AGAINST AIRCRAFT, TANKS, AND GAS

Anti-Aircraft:—Because of the shortage in airplanes to engage the enemy air forces, the infantry must arrange for its own defenses against them to a greater extent than heretofore.

"Low flying airplanes are to be driven off by machine gun fire."

Protection Against Aircraft:—The men are to be drilled in what to do in case of an air attack. They should seek immediate shelter under trees, in barracks or dugouts, or deploy along walls and hedges, remaining motionless. In the open where there is no protection against shell splinters, they must throw themselves flat upon the ground as quickly as possible, keeping the head close down.

When possible, large troop movements take place at night. Main roads, large columns, and gathering in villages are avoided. On the approach of hostile planes, which may be expected to drop parachute lights, cover is either taken at the side of the road, under trees and in ditches, or else the troops face about and march in the opposite direction.

Anti-Tank Defense:—Tanks are dangerous for the infantry only at very close range, (less than 100 meters), on account of the inaccuracy of their fire. Beyond this distance excellent results can be obtained with anti-tank rifles, machine guns, and concentrated charges.

The infantry will withdraw to permit the fire of the artillery and trench mortars and engage in combat against the enemy infantry, which generally follows at a considerable distance.

Anti-Tank Instruction:—Courses of 8 days were held in January. A large number took part as spectators. Wooden tanks were used, at which machine guns and trench mortars fired until the tanks had penetrated beyond the second line, when the defense was taken over by the artillery. Instruction in the vulnerable parts of the tank was given.

Anti-Tank Rifle:—A single shot Mauser model, very strong and simple in construction. The caliber is 13.4 mm., the weight 17 kg., and the length 1.69 meters. It is mounted on a fixed bipod 29.5 mm. in height. It is sighted up to 500 meters and fires a non-explosive bullet which pierces a 21 mm. steel plate at 200 meters.

The allotment is 2 per regiment. They are placed on the main line of resistance or just behind it. Each is served by two men, a rifleman and an ammunition carrier who is the reserve rifleman. Due to an excessive recoil and barrel heating, only 20 shots per minute can be fired. This slow rate of fire, its weight and size prevent its being formidable.

Anti-Tank Ammunition:—Each soldier is issued 10 steel cased bullets. The two best bombers out of every nine are designated to attack tanks with bunches of five grenades wired together, which are thrown on top of the tanks.

Anti-Tank Machine Guns:—Heavy machine guns are supplied with armor-piercing cartridges. Each must combat tanks which penetrate into its zone. Those which are placed at points especially liable to tank penetration are designated "anti-tank machine guns."

Tank Vulnerability:—"Tanks are best attacked from the rear."

Tank Barriers:—"Tank Sperren", erected in village streets, consist of a palisade of small iron girders set to a depth of three meters below the ground in concrete. The girders rise to a height of 2 meters and are inclined at an angle of 70 degrees towards the enemy. There is a gap in the middle large enough for a limber to pass.

Anti-Tank Mines:—Anti-tank mines complete the action of the other arms in anti-tank defense. They consist of wooden boxes 8 x 10 x 2 inches, painted and camouflaged to suit the ground where they are to be laid. They are best placed in the outpost zone and secondly in strong points of the intermediate zone and in the supporting positions. A heavy weight passing over explodes them.

Anti-Tank Groups:—"In the forward battle zone, anti-tank groups, under especially energetic leaders, are to be formed. These will consist of anti-tank guns, machine guns, anti-tank rifles, and trench mortars. The various weapons of these groups need not be close together, but they must be able to render mutual support within their group, except in the case of anti-tank rifles, which must be in groups of four to six. Groups are to be distributed in depth in the battle zone.

Anti-Tank Forts:—Localities called "tank forts" have been organized for anti-tank defense. They are equipped with field guns, mortars, anti-tank rifles, machine guns, and searchlights. All weapons in each are mutually supporting. The area of the forts varies with local conditions up to several hundred square yards. They are located from just behind the main line of resistance to 1000 meters back.

Evacuation of Gassed Areas:—Localities frequently under artillery fire, where gas remains particularly long, such as ravines and thickets, will be temporarily evacuated under certain circumstances. Accurate reconnaissances are necessary when the weather changes, in order to determine the extent of the evacuation required and the proper moment for reoccupation.

Gas Discipline:—"The French gas renders a still stricter gas discipline necessary. N.C.O's., must keep constantly on the watch. Our troops must know that our masks afford full protection if adjusted in time."

14. RETREAT.

Withdrawal from Sector to a new line is carried on at night. The reserve battalions are the first to move out of the old positions into the new; they are followed by the support battalions, and lastly the front line battalions. The latter leave patrols in the old line who continue to show activity and, unless hard pressed, do not fall back on the rear guard companies until the following night.

Ammunition during Retreat:—In those areas liable to be evacuated the stock of ammunition in dumps and battery positions should not be increased beyond the amount necessary to repel a hostile surprise attack, lest with the shortage of transport and the present method of withdrawal with a minimum of casualties, great sacrifices of it have to be made to the enemy.

Yperiting Dugouts:—Before the evacuation of positions in retreat demolition detachments yperite the dugouts. A 105 mm. Yellow Cross shell is placed on end in the dugout, the fuse, an extra long one, is lighted, the doors are closed, and the curtains are lowered. Several dugouts which are to be used by the men left until the last are excepted.

Explosive Traps:—When making an organized withdrawal certain positions, dugouts, dumps, etc., are mined, the firing arrangements being such that the charges are exploded after they have been occupied by the enemy. There is a large variety of firing devices which may be roughly classified as follows:

1. Delayed action fuses—the "delay" may even be as long as a month.
2. Time clock fuses.
3. Percussion detonators—exploded when force is applied to a set object.
4. Electrical dischargers—for which pressure of some sort completes the circuit.
5. Long distance electric discharger—fired by connecting a circuit over telephone wires at a moment unfavorable to the enemy.

The following are a few examples of traps that are exploded by one of the above methods:

1. A shovel stuck into the side of a dugout between the timbers; when the shovel is removed, it pulls a wire which explodes the mine.
2. A French stove with stove-pipe dismantled; one wire attached to leg of stove and the other to stove-pipe near by. When the stove-pipe is picked up, a mine is fired.
3. A window weight suspended by a fine cord stretched across the entrance of a dugout. On a man entering, the cord would be broken and the weight fall into a box of detonators connected with a charge of explosive.
4. Cap badges, artificial flowers, bits of evergreen, pieces of shell and other articles likely to be picked up as "souvenirs" left in dugouts and attached to charges.
5. A false step in the stairway of a dugout of thin planking making a contact when trodden on.
6. A cavity hollowed out under the road, leaving only the crust. An 8-9 inch shell is placed in the cavity with a contact fuse arranged to fire at the slightest pressure.

III.

ARTILLERY

1. PREPARATION

Grouping for the Offensive:—For the offensives of 1918 the German artillery was divided, as during the Russian campaigns of 1917, into two main tactical groups: (1) *Artillery battle artillery,*—for counter-battery fire, usually under the command of the Army or of the unit responsible for the whole attack. (2) *Infantry battle artillery*—under the chief command during the preliminary bombardment, but passing to the command of the divisions for barrage, harassing and destructive fire. In addition were (3) the *heavy, flat-trajectory guns,* under the command of the corps or army headquarters, and (4) the batteries to accompany the infantry.

Assignment to Troops:—Divisions:—For the attack on March 21, in the German XVIIIth army, each first line division was assigned two regiments of field artillery and six to ten heavy, long-range batteries. During April two regiments were assigned to an attack division, (the 77th Reserve); one of these was employed to supply infantry with accompanying batteries.

Regimental Organization:—In the composition of field artillery regiments, a proportion of one-third howitzers was the general rule. In the spring the 7th Guard Field Artillery Regiment was composed of three groups; in each group, two batteries of four 77 mm. guns and one of four 105 mm. howitzers.

Battalion Organization:—After July 18, heavy artillery battalions (except Landwehr battalions) appear regularly to have been composed of three batteries each; in seventy-five per cent of the battalions there were two batteries of long guns and one of short guns.

Concealment of Preparations:—"All the German offensives since the summer of 1917 were characterized by a vigorous action of a powerful force of artillery coming into line without giving indication."

Secret Concentration:—Greatest secrecy was maintained in preparations for the Picardy and Aisne offensives; in both cases the location of artillery reinforcements was begun several weeks before the attack. It was carried out in such a way as to avoid the appearance of abnormal traffic in the rear zones. Secrecy in concentration was obtained by enforcement of strict march discipline and the movement to and occupation of positions by night. Unnecessary lights, noise, etc., were forbidden. A captured order dealing with preparations for the Aisne offensive, specifies means for reducing noise made by materiel in movement; lapping wheels with rope, padding horses' hoofs, etc.

Mode of Fire Adjustment:—Secrecy in the preparation for fire usually obtained by the reduction of preliminary adjusting fire to a minimum. Very close adjustment prior to an offensive was not in general considered necessary, in view of the nature of firing to be done: *i.e.*, neutralization fire, which does not require as accurate shooting as destructive fire.

Elimination of Registration Fire:—Total elimination of registration fire was accomplished through the use of already existing emplacements for which firing data was available. And even in the occupation of new emplacements by the Pulkowski method.

Registration Fire Methods:—The purpose of registration fire when carried out was concealed in various ways: by carrying it out several weeks before the attack in which the fire for effect was to be employed; by firing a minimum number of shots for registration, masked by the fire of a battery the position of which was already known to the enemy; by the aerial observation of "high bursts" in the midst of an apparent fire for effect. Where the fire for effect by heavy batteries was not to be done until some time after the registration, aerial observation at the time of firing was occasionally eliminated by the study of aerial photographs of the points of impact.

The IInd Bavarian Corps, by excessive registration from as many points as possible, sought to accustom the Allies to a large amount of registration, in order that registration carried out in preparation for an attack would not attract any particular attention.

Purpose of Preparatory Fire:—The purpose of the preparatory fire, as expressed by Ludendorff in an order of July 22, appears not to have been a complete destruction of trenches and obstacles, which cannot be effected even after bombardment lasting several days; it was, rather, by a short bombardment of the whole zone of the attack, to "effect a partial and comparatively slight destruction; but on the other hand to paralyze the adversary and exploit this success through the immediate action of the Infantry."

Duration and Periods of Fire:—The duration of the preparatory fire was invariably short in comparison with that preceding the British Somme offensive of 1916 (8 days) and Messines Ridge attack in June, 1917 (5 days); it averaged between 2½ and 5 hours; Picardy offensive, March 21, 5 hours; attack on Villers Bretonneux, April 24, 2¼ hours; attack in Kemmel region, April 25, 3½ hours; Aisne offensive, May 27, 3½ hours; the attack of June 12 between the Aisne and the Foret de Retz, 1 hour; Champagne offensive, July 15, 3 hours 40 minutes. The preparatory fire of 1 hour on June 12th was too short and failed to have much moral effect. The schedules for the preparatory fire were regularly divided into periods: in the first periods, fire with gas shell was directed on the artillery; in the latter periods H.E. and gas shells on the infantry positions; on July 15 in Champagne the two hours' fire on the infantry prior to the assault was interrupted 45 minutes before the infantry advance began, by a 15 minute concentrated burst on the Allied batteries.

2. EMPLOYMENT OF PROJECTILES IN THE OFFENSIVE

Improved Use of Gas Shell:—In December, 1917, German Regulations for Artillery gas fire stated that gas shelling could rarely be used against the enemy's advanced positions. As late as Feb. 20th there is evidence that considerable want of confidence existed in the German army in the use of gas shell in conjunction with an assault. An order of Ludendorff (June 20) testifies to a technical advance in the use of gas shelling, carried out through experiments, training, and improvements in means of protection, whereby, the width of the danger zone to his own troops had been materially reduced.

Types of Shell:—(1) *Green Cross* and *Green Cross No.* 3 (formerly *Yellow Cross No.* 1); a few breaths fatal, though protection is afforded by

the mask; this gas is not persistent, and hence was used for temporarily paralyzing hostile artillery, but could not be counted on for causing permanent evacuation of positions.

(2) *Blue Cross;* an almost instantaneous but not a lasting effect; when sufficiently dense it may penetrate and cause the enemy to remove masks, and hence was frequently mixed with Green Cross. As its effect disappears rapidly, it could be used when the German infantry was near and employed for barrage fire or against machine-gun nests

(3) *Yellow Cross* (mustard gas) takes effect slowly, but is very persistent. Used in forcing the enemy to evacuate positions. By using shell combining H.E. and Yellow Cross gas, the effect was intense, but the persistency might be reduced to one-third; this made it possible for German infantry to cross ground shelled by the Yellow Cross H.E. shell only a few hours after shelling.

Employment of Gas Shell in Attack:—An unprecedented use of gas-shelling was made in the artillery preparation, for harassing the rear, for shelling batteries, and also for area shelling. In bombardment before the attack of March 21, gas shells mixed with H.E. were used along the whole British front; in the sector attacked, gas shells comprised 25% of the total fired. They were distributed in depth 8 miles behind the lines, although the bulk fell within a 3 mile zone. The gas tactics here employed were to leave certain sectors free of gas; through these sectors attacks were made, forming wedges between which the defender's strong points became salients; gas shelling, particularly with Yellow Cross shell, played a conspicuous part in forcing the evacuation of these salients. Blue Cross shells were largely employed in the preparatory fire before the Picardy and Aisne offensive in the latter case; the front was left clear of gas but the rear zone bombarded to a depth of 12 to 15 kilometers. A corps order of April 17 recommends that in neutralization of zones of machine gun nests prior to attack, artillery and trench mortars should especially concentrate their fire on points of penetration; using exclusively high explosive on the zone in depth about 300 yards to the rear of the enemy's foremost outpost line and H.E. and gas on the zone 660 to 1100 yards to the rear.

Surprise Tactics with Gas Shells:—One American division reported that the Germans had been using special gas tactics against American divisions arriving in line for the first time. For three weeks, they would use gas which produced sneezing only, thereby inducing laxity in gas discipline; "after presumed accomplishment of this, the most poisonous gases were used."

Smoke Shells:—The use of smoke shells was considered to be in an experimental stage as late as July 9th; at that date, according to a circular of the Chief of Staff, there were no smoke shells available except for howitzers; their utility lay in giving security to the flanks and in blinding observation posts. An undated French report quoted in the Chemical Warfare Summary gives an account of a successful fog attack, preceded by a heavy smoke shell bombardment of 4 hours and 20 minutes along a front of 20 kilometers and to a depth of 8 kilometers, producing a fog so dense that it was impossible to see men or objects in it.

3. BARRAGES IN THE OFFENSIVE

Purpose of Barrage:—In an order Feburary 8th, Ludendorff emphasized the fact that the barrage at best could be but a light curtain of fire which

could not save the infantry from the necessity of combat with machine guns, rifles and bayonets. The object of the barrage was to paralyze, but not to annihilate, the enemy's infantry during the advance, and to force him to keep under cover.

Depth of Rolling Barrage:—The British General Staff in notes of May 6th, criticised the Germans for failure to give sufficient depth to the barrage; stating that they thereby "failed to neutralize distant machine guns." This criticism is valid in regard to the barrage of June 12 in the attack between the Aisne and the Foret de Retz, which went too fast for the infantry and, though heavy, was not sufficiently deep to neutralize simultaneously the machine guns of successive lines. Orders for the advance of the barrage in the German IIIrd Army on July 15 stressed the importance of a sufficiently dense barrage to prevent the fire of machine guns on the infantry; this was to be accomplished by having a secondary gas-shell barrage precede the main barrage of H.E. shells in certain sectors.

Timing the Barrage:—The rolling barrage of March 21 began with an initial bound of 300 meters for all zones; thenceforth the light artillery to progress in bounds of 200 meters every 4 minutes, the heavy howitzers 400 meters every 8 minutes, The 150's were to lift one minute ahead of the field guns on each bound. Counter batteries were to join in the rolling barrage when it passed their objectives. In the attacks of April and May the rates of advance were materially reduced.

Liaison with Infantry:—In the attack of March 21, the time schedule was obligatory, the infantry advance to be subordinated thereto. It was to be modified only by the use of simple signals in case the batteries accompanying the infantry failed to reduce unforeseen obstacles. Ludendorff, however, repeatedly criticised excessive rigidity in the adherence to a time schedule of the rolling barrage, and, through recognizing the difficulties of communication between the artillery and the infantry, on July 22, laid it down as essential at least in part "to subordinate the rolling barrage to the infantry." The rolling barrage even when well adjusted is almost of no use if it loses liaison with the infantry. "We therefore should always seek to direct the rolling barrage, or at least a part of the batteries which take part in it, in accordance with the actual situation of the infantry. The infantry must make use of signals, etc., more than it has hitherto done, in order to furnish the artillery with better data for its fire."

Box Barrages:—In the attacks of May 27 and June 9, in addition to the rolling barrage, use was made of successive standing and box barrages on particular points of resistance. These were executed on June 9th by a special group of 77's which "had a wide field of fire and swung from one point of resistance to another, according to a separate time-table."

4. MOBILE ARTILLERY IN THE ATTACK

Advantages Mentioned 1917:—The advantages on the *defensive* of using mobile artillery to accompany the infantry into action in the battle zone for repelling hostile troops were pointed out by Ludendorff in Aug. 1917.

Purpose of Mobile Artillery in Offensive:—In 1918 accompanying artillery was used in the *Offensives*. Its purposes were, by affording close support to the infantry, to enable the latter to overcome machine-gun nests and strong positions still held, to repulse counter attacks and tanks, to protect its flanks, and to penetrate points where the advance was easy and re-

serves were to be sent in. The infantry, by its weapons alone, could rarely carry out these missions, and hence some field pieces and light trench mortars were placed directly under the orders of the infantry battalion.

Distribution:—The quantity of artillery used has varied; in the German XVIIIth army on March 21 one battery was assigned to each infantry regiment; in the attacks of May 27 and June 9 the amount was increased to one battery to each battalion in the first line and one battery to each regiment in the second line. In April and afterwards a distinction was made between accompanying artillery under orders of the regimental commander, and the Infantry batteries assigned to the battalion.

Materiel, Light Artillery:—Materiel used for this mobile artillery was composed of light field guns, light and medium trench mortars, and light field howitzers; a variety of types have been employed but, for the most part 77 mm. caliber field guns; A XIIIth Corps order of April 17 testifies to the satisfactory results attained in the reduction of machine gun nests by use of single light field howitzers, "in or immediately in rear of the assault trenches." High explosive and Blue Cross explosive shells were expecially recommended for infantry artillery; on July 22 it was stated that smoke shells were soon to be put into service.

Cooperation with Infantry:—Orders emphasized the necessity of the closest cooperation between accompanying artillery and the infantry; to this end, the accompanying artillery was placed under the infantry commander, who assigned the mission to the artillery but left the details of its execution to the artillery commander. The post of the artillery commander as far as possible was to be with the regimental commander. Further cooperation with the infantry troops was attained through training (especially in combined maneuvers). Communication was to be constantly maintained by all practicable means between the guns or howitzers, the battalion commander, and an artillery observer in the foremost infantry line. In order to prevent infantry from outdistancing its accompanying artillery, all reserve troops, whether specially detailed for the purpose or not, must assist in moving up the accompanying batteries and ammunition whenever there is need.

Heavy Howitzers:—In addition to the accompanying artillery there is evidence that a supplementary reinforcement of heavy field howitzers was occasionally assigned to the infantry regiment for direct support in the zone of combat in open warfare.

Engineer Assistance to Artillery:—Information derived from prisoners indicates that in the training in the winter it was considered necessary that in an attack each battery have a detachment of engineers at its disposition to overcome obstacles to its advance. An order of March 29th indicates that experiments carried out by pioneers had produced good results in facilitating the crossing of trenches by artillery. The method was to blow in the walls of the trenches from the sides and cover the passage. This to be done by 4 small detachments for each crossing, each detachment consisting of 4 pioneers and 4 artillerymen under a pioneer non-commissioned officer. Reconnoitering was done by one pioneer and one chief of artillery section. In the attack of March 21, by the 50th Div., 1½ companies of pioneers were attached to each front line regiment.

5. RAIDS

French comment on trench raiding activity in March and April testified to an increase in the importance of artillery fire both in preparation for and accompanying the raids. Almost all raids had been prepared for by gas shell fire the preceding day on the French batteries and command post. Important raids were preceded by the usual indications of a serious attack. The preparatory bombardment was characteristically *brief;* in the case of the raid on Cheppy Wood, April 9, lasting only one minute before the launching of the infantry attack; in that of April 12 it was entirely dispensed with. Captured regimental orders for a raid west of Cantigny on May 27 show that it was to be preceded by a four hour bombardment; two hours against the hostile artillery with gas; and two hours fire of destruction on the trenches. During the raid a box barrage was to be put down on the hostile rear positions.

6. DISPOSITION AND EMPLOYMENT OF ARTILLERY FOR DEFENSE

Grouping:—For the *defensive,* artillery was divided into two main groups; (1) Heavy, flat trajectory group under corps or army H. Q. and (2) Field and heavy artillery under the divisional artillery commander. The latter was subdivided into (a) close range combat groups, mostly of field pieces, for dealing with forward areas and barrages; and (b) a long range combat group, exclusively heavy artillery for shelling the rear and for counter-battery fire.

Echelonment:—A Ludendorff order of July 22 indicates that the essential points of the defense are "echelonment in depth and flanking fire." "Artillery echeloned in great depth is difficult to neutralize. Flanking fire has great moral and material effect" on an enemy who has succeeded in breaking into the defense.

Organization of Positions:—Captured documents show that formations in depth were adhered to. The German defensive organization was divided into three main zones:

(1) *The Advance Zone*
Consisting of:
1. Security line.
2. Barrier line
3. Principal line of resistance.

(2) *The Main Battle Zone*
Consisting of:
1. Security line.
2. Line of artillery protection.
3. Principal line of resistance.

(3) *Rearward Battle Zone.*

Anti-Tank and Close Combat Pieces:—In front of the line of artillery protection were stationed various batteries with special missions; anti-tank and close-combat flanking pieces in, or immediately in rear of, the principal line of resistance; and surveillance batteries distributed through the main combat zone. To each of the latter was assigned the protection of a sector of the advance zone.

Divisional Artillery:—The mass of the divisional artillery was concentrated in the rear part of the main battle zone in and behind what was called the *line of artillery protection;* in the dispositions for the attacks of Aug. 17-20 north of the Aisne, this line was about four kilometers from the principal line of resistance. In this line the long-range combat batteries held the foremost position in order to utilize their range to the maximum To the rear of these were echeloned the short-range combat batteries in a position to lay effective barrages in front of the advance zone; to the rear of these, far enough back to be outside the zone of action of the mass of the hostile artillery, surveillance batteries, to remain silent until called on to open barrage or annihilating fire on any enemy forces that might penetrate as far as the front of the main battle zone. An order of the 202nd Division requires that each battery in the divisional area must have, besides its principal position, a withdrawal position and an alternative position. Sections of field artillery and nomad pieces of heavy artillery are to move about executing special missions here and there; their combined effect with that of the "working" pieces, is to give the enemy the impression of a much stronger artillery force than is really present.

Artillery Reserves:—In the rearward battle zone the mobile divisional, army corps, and army reserves were held in readiness to be engaged where the situation demanded.

Machine guns and Artillery:—The regular allotment of two machine guns to an artillery battery, begun in 1917, was almost exclusively for *defensive* purposes. These machine guns were to be manned by the artillerymen; one was usually placed at the battery position and one at the wagon lines; their uses were for anti-aircraft defense and for engaging the enemy in case he broke the lines. Concealed machine gun nests manned by special detachments of picked machine gunners were often established near Field batteries as a support to the artillery in the defense, especially against tanks, and to fire against airplanes.

Offensive—Defensive:—An extremely significant order of Ludendorff of June 22nd emphasized the importance of mobility and aggressiveness in the defense. "The artillery must . . . have an offensive attitude in the defence." If the defender is well concealed and constantly changes his position, the attack cannot injure him seriously. "The attacker who comes under the fire of batteries located well in the rear and flanking machine guns offers a weak resistance to counter attacks." Moreover, the artillery must not become hampered by a rigid defensive scheme; it must actively seek for objectives in the combat zone, even though this requires "a conscious renunciation of the maximum intensity of the barrage." An organization of artillery designed to produce a perfect barrage cannot, in addition, take an active part in offensive firing.

Methods of Defensive Fire:—The surest means of defense was held to be fire of destruction before the attack rather than a barrage at the moment of attack. This was to consist of destructive counter-battery and C. O. P. fire concentrated on the supposed assembly points of hostile troops. "A severe bombardment which presages preparations for an attack must be answered by rafales of annihilating fire," directed as far as possible by observation.

Counter-Battery Fire and C. O. P. Barrages:—When the attack starts; counter-battery fire to be continued by batteries designated for it; C. O. P. fire on the enemy's trenches, and barrages by long and short range guns. When the enemy penetrates the outpost zone he is subjected to annihilating fire by the surveillance batteries, each one of which is responsible for a sector of the outpost zone. The barrage also may be brought back into the outpost zone; this was to be done with great care, in view of danger to the German infantry. "When a rolling fire is opened on a wide front and comprises a large proportion of smoke shells, our artillery should answer at once by barrage fire without awaiting the signal, for it must be expected that the enemy is following immediately in the rear." The use of barrage fire for defensive purposes, however, was in general discouraged; an order of the IInd Army of May 7 admitted that it must be retained as a "necessary evil" in fogs, at night or at other times when the extent of the enemy attack was uncertain; but that otherwise "annihilating fire" was to be employed. We have an example in August of the carrying out of this policy: the complete suppression of "the schematic barrage fire . . . which hitherto had been placed as a screen of fire in front of the infantry in case of an imminent enemy attack. Annihilating fire only was to be used, directed against the enemy himself when he is observed, or against the presumed positions" in which he is making for the attack or across which he will pass. The signal "barrage fire" was forbidden.

Enemy Break Through:—"If the enemy breaks through, the batteries should become centers of resistance round which the infantry can form. They must be defended with rifle and grenade. Some selected positions should be surrounded by low wire."

7. ANTI-TANK DEFENSE

Increased Materiel:—Early in the winter anti-tank batteries were being disposed of: field and heavy artillery was considered sufficient to engage tanks. But since the operations of the spring and summer began much emphasis has been laid in many German orders on the importance of anti-tank defense. Special anti-tank materiel was increased. On Aug. 22, the 214th Division recieved 16 additional anti-tank guns, raising the total to 28 permanent anti-tank guns. A corps order of June 23 requires that the greatest possible number of guns should participate in anti-tank combat; in addition to the special anti-tank guns in the forward zone, each division was to designate a section from the field artillery to be held in readiness outside the line for "urgent" alarm when tanks break through. Heavy batteries with good opportunity for observation were considered especially efficient against the tanks.

Position of Anti-Tank Guns:—"In each regimental sector a field gun with armor-piercing shell is placed in the outpost zone to fire on tanks. These anti-tank guns, which should have a large lateral field of fire, use direct fire. In addition, an anti-tank surveillance battery is placed on both flanks of the division." The armament of an anti-tank fort included one or two field guns.

Mobility:—An order of the Crown Prince's Army Group of Aug. 12 states that tanks have frequently broken through the fronts of the IInd and XVIIIth Armies and attacked batteries and division H. Q., and that it was impossible to organize the defense in time, because the artillery lacked sufficient mobility. The guns were too deeply dug in and were not able

to fire in time against the tanks attacking from any direction. To attain mobility for anti-tank defense, it was recommended that observation facilities should be increased and guns arranged with a view to admitting of quick withdrawal from their positions and of fire in all directions. Mobile anti-tank sections should be increased.

Machine Gun Nests:—Concealed machine gun nests, manned by special detachments of picked machine gunners were often established near field batteries for protection of the batteries against tanks; in April these detachments were being provided with 20 mm. anti-tank guns.

8. PROTECTION AGAINST COUNTER-BATTERY FIRE

Movement:—Besides measures of camouflage and concealment, constant moving of the batteries was used to deceive the allied artillery observers. A daily change of position was required of certain batteries of the 2nd Bavarian Division before the French attack of July 18. In June reports were made of the placing of large amounts of light artillery in the open fields away from known emplacements, but near the front lines in a position for immediate action. On the Flanders front alternative positions were often prepared for batteries under hostile observation or exposed to counter battery fire. One gun was always left in the vacated position, while the remaining guns fired from the new positions. One or two pieces, called "working" pieces were often employed to do all the firing for a battery from a position relatively far from the rear emplacements.

Ruses:—Blank cartridges and dummy puffs fired from dummy positions were not considered effective; smoke rings were more useful in deceiving the enemy. The French Xth Army Bul. Sept. 10, testified to the use of anti-flash packets as one cause for the increasing difficulties encountered by their observation sections in obtaining intersections of German batteries.

9. ARTILLERY AND AVIATION

Aerial observation was especially helpful to the artillery in an advance by providing it with information of the location of hostile batteries, fleeting targets, columns on the march, etc. *Airplanes* were sent out to reconnoiter in front of the lines, communicating back by wireless or by dropping messages. They were also used to observe fire of adjustment. A customary assignment was 4 artillery airplanes to each divisional artillery commander. *Balloons* were used for similar purposes. Though they could not be sent out in front of the lines for reconnaissance, good results were obtained by moving them far forward. Special balloon batteries were created of heavy 10 cm. and 13 cm. field howitzers; they were required to keep in constant direct communication with their balloons. An order of July 13 provided for a balloon group of four or five batteries of heavy artillery and howitzers with an attached balloon; the group was to act on its own initiative. As far as possible the choice of targets and order of engaging them was left to the observers. The principal mission of the commander was to make sure that there was always a part of the group ready for instant action.

10. TRENCH MORTARS

Organization:—The German Trench mortar manual of July 1, 1917, provided for a divisional company of 4 heavy and 8 medium trench mortars (forming part of the Pioneer battalion); also 4 light trench mortars per infantry battalion. By the Spring of 1918 the latter had been reduced to 2 per battalion. A General Order of Aug. 17 demanded the dissolution of the divisional trench mortar company and, by the uniting of its elements with the battalion detachments, the formation of regimental companies. The regimental company thus composed consisted in a typical case, of 3 sections of 3 light mortars; also 2 to 3 medium mortars contributed by the divisional company as a reserve. The purpose of this reorganization was to obtain more effective anti-tank defense. Owing to their restricted range and greater weight the *heavy trench mortars* were neither as valuable nor as much used as the light and medium types. They were frequently withdrawn and held in the rear.

Fire:—Trench mortars have played an important part in the preparatory fire; for this purpose they were sometimes placed far to the front (in order to make the maximum use of their range) and, in one case, even in front of the infantry positions. Light trench mortars were also required to participate in the rolling barrage and to lay down box barrages and annihilation fire during large scale attacks as well as trench raids. Gas shells apparently were little employed by trench mortars.

Advance:—Trench mortars have been used with varying success to accompany the infantry in the advance. During the Picardy Offensive they apparently had trouble in keeping up. The French G. Q. G. Bul. stated that it had been established that only a limited number either of medium or of light trench mortars could advance fast enough and that very few could give effective support to the infantry in rough country. This was due to difficulty both in the transportation of the mortars themselves and in bringing up the ammunition supply. Lack of horses often forced the abandonment f pieces. These difficulties were apparently surmounted by the time of the Aisne offensive. The British, in commenting on the fighting at that time, laid particular stress on the rapidity with which the enemy succeeded in bringing up his light trench mortars, which "were drawn by horses and got into action more quickly, and were of greater use than the field artillery which also accompanied the infantry."

In the advance the *light Trench Mortars* followed close behind the infantry battalions to which they were attached. Like the accompanying artillery, they gave support to the attacking infantry, especially by reducing or neutralizing machine-gun nests, and by breaking up offensive returns. For these purposes intensified effect was gained by a new type of carriage, apparently first put into general use in the Picardy offensive, which permitted direct fire, and, with its large wheels, greater mobility, speed and ease in emplacing the piece. The main disadvantage in the employment of Trench Mortars in an advance appears to have been their conspicuousness Attempts were made at concealment by the use of smoke screens.

The use of *medium Trench Mortars* in the reduction of machine gun nests differed little from that of light mortars; in addition they were valuable in supporting the infantry in case of a check before farms, villages or unexpected obstacles. They could also be used to fire on the flanks and rear of the enemy if the latter were able to hold back a neighboring division behind the general line reached by the division to which they were attached.

Before the July 15th attack all these types of trench mortars were used in creating swathes or lanes for the assault troops across the French defensive organization. For this purpose, in the XIIth Army Corps 230 mortars were concentrated on a front of 6 kilometers. Each company was to open a lane 250 meters wide by 600 meters deep.

Defense:—An order of the General Staff of Aug. 22, 1917, asserts the value of light Trench Mortars in the rear of a defensive system. In 1918 they appear also in the more forward parts of the cambat zone; we find them echeloned throughout this area in groups of two or more. An order of Aug. 13, 1918 requires 2 light mortars to make use of alternative positions in the outpost zone of each regimental sector. The reason for this moving forward of trench artillery was to provide a maximum fire for anti-tank defense; to facilitate this was a chief cause of the development and improvement of the new type of carriage for direct, flat-trajectory fire. The tank forts were usually equipped with two or three light trench mortars.

IV.

AVIATION

Concentration on Active Fronts:—Owing in part to shortage of effectives the Germans began in their first offensive of 1918 the practice of concentrating on active fronts at the expense of quiet sectors. Early in April, the majority of the units in Northern Flanders were found to have been brought to the La Bassee sector. The practice became more marked during the summer. Numerous extra airdromes for the accommodation of transferred units were remarked in August along the front from the Argonne to Switzerland.

Special Mobile Formations:—Concentration was facilitated by the development of units, composed of picked personnel and equipped with the latest types of machines, to be used only on active fronts. Richthofen's First Pursuit Squadron, made up of four flights, was organized in October, 1917. Early in May, 1918, the British found the permanent squadron formation prevailing all along the active battle line, in place of the flights and groups existing elsewhere Such a unit was better adapted than were separate flights to enter rapidly into action upon transfer, as it was under the administrative and tactical control of one commander who had only to get in touch with the staff directing operations Certain of these squadrons, notably the First, were picked especially for emergency duty, and their presence in a sector was recognized as an important indication of intentions. Protective flights, in their new role of low-flying action against troops, came also to be reserved entirely for active fronts and to have the some significance. One four-flight squadron was identified as having worked in both the Picardy and Aisne offensives. Bombing squadrons for use in active sectors appeared early in the year.

Reconnaissance Preliminary to Offensive:—A thorough reconnaissance of the enemy's front lines and rear areas preceded each of the offensives of 1918. British officers testified to the effectiveness of the artillery fire and bombing and to the familiarity with trench and wire systems which resulted from the preliminary reconnaissance in March. The extent of this reconnaissance was kept concealed. A Ludendorff order directed that the machines should return separately and without escort, in order not to reveal the importance of the mission, and so that the aviators could say if captured that they had simply lost their way.

Reconnaissance on Defensive:—With the German armies thrown on the defensive, the task of reconnaissance became more complex and no longer lent itself to a neat proportioning of efforts and risks to results. Signs of preparation for attack must be watched for everywhere and at all times; and attention could be concentrated upon a particular region only when activity there was definitely ascertained or expected. Thus numerous reconnaissances were noted over the Arras front in the first days of August. But negative results could never be accepted as final. Later in August, the Higher Command in Alsace multiplied reconnaissances behind the Allied lines without being able to allay its nervousness about the possibility of an offensive there.

Reconnaissance in Battle:—Open warfare, with frequent and rapid changes in positions, necessitated a concentration of attention upon the actual line of battle. According to French and British sources, observation

in the first offensive was largely confined, once the attack was under way, to the first lines; and an information report of the 4th Reserve Division shows the care and precision with which this form of reconnaissance was carried out. The French state that during the offensive of the 13th of June the observation activity over their lines was greater than during the March offensive. Almost no deep reconnaissances were undertaken in either battle.

Division Reconnaissance Flights:—Front-line reconnaissance, contact with infantry, and co-operation in artillery registration fell chiefly to the air units attached to divisions. From a French study of the operations of the 18th Army, it appeared that one reconnaissance flight was attached to each division for these purposes. The flights allotted on main battle fronts usually moved with the divisions to which they were attached; and the general practice resulted of assigning one flight of nine machines permanently to each division. Out of five reconnaissance flights at the disposal of the 54th Corps, three were allotted to divisions, one reserved for long-distance reconnaissance, and one for co-operation with the corps artillery.

Infantry Contact Patrols:—Great emphasis was laid upon the work of the planes which maintained contact with infantry. A 54th Corps order, dated May 13th, states that: "They reconnoiter and observe the advance of the infantry" and "make known . . . the hindrances to the advance, the hostile points of support not yet immobilized, hostile counter-attacks in preparation, and the approach of tanks." According to the same order, and also to a 13th Division order of July 4th, they were to keep the division command posted as to the lines held by its infantry, and to carry back situation reports from battalion headquarters. A 33rd Division order of May 24th directs them to carry rations, ammunition, and medical supplies to isolated detachments, dropping the articles in parachute baskets. These documents also urge that the infantry be brought to appreciate and co-operate with this service by calling attention to it in lectures, instructions, and tracts. Examples of this "propaganda" have been captured. Special armored planes were produced for the low-flying duties of contact patrols.

Pursuit Plane Barrage to Mask Concentration:—The main role of pursuit aviation in an offensive consisted in putting up a barrage against enemy reconnaissance at the moment of concentration for attack. This feature characterized each offensive of the year. The machines acted, not in mass formation, as 1917 instructions contemplated, but in patrols of varying size. The aerial barrage, turned to defensive use, was put up in Flanders early in August to mask preparations for meeting an expected attack. The exploits of the Second Squadron in the St. Mihiel region appear to have had as their object the screening of the movements of retreat and taking up new lines.

Pursuit Aviation in Battle:—The regular occupation of pursuit flights, that of maintaining patrols to chase away enemy planes, continued during a battle, though with less intensity than in the days preceding it. The decrease and purely defensive character of activity was at first so marked as to excite comment from the Allies and complaints from other branches of the German service. A protest was addressed to the First Squadron for not opening the way to deeper reconnaissance. More aggressiveness was shown in the later offensives, although the French remarked that 'the enemy did not exhaust himself at any time by endeavoring to obtain

control of the air." Attacks on observation balloons were frequent, being carried out usually by more than one plane and by taking advantage of clouds or direction of the sun.

Pursuit Escorts:—The diversion of protective flights to attacking troops on the ground threw the duty of escorting reconnaissances upon the pursuit flights. The confining of battle reconnaissance to front lines left little difference between this duty and that of patrols. It was felt to be neglected in the first offensive. The deficiency was so remedied that in the attack on Kemmel Hill each observation plane or balloon had an escort of pursuit planes. Escorts were also furnished for special deep reconnaissances, seven machines accompanying one Rumpler on a mission north of the Somme in May.

Attacks upon Troops:—Machine gun and bomb attacks by airplanes upon troops were increasingly resorted to. Ludendorff directed that reconnaissance and protective planes should be trained for this work, which was to be carried out by small groups flying in files. An order of June 24th included pursuit and even night-bombing planes, urging that: "The holding up for an hour, or even half an hour, of the enemy's troop trains or motor transport and troop columns by the Air Service may have a greater influence on the issue of a battle than shooting down a greater or smaller number of hostile machines." Machine gun fire on front line trenches has been used both to open the way for an attack and to break up an expected one.

Protective or Battle Flights:—The two-seater fighting planes of the protective units proved especially suited to the attack upon troops and were trained for it from the first. While other types engaged sporadically in this fighting, the protective flights were reserved almost exclusively for it. They were equipped in part with armored planes, and planes carrying four machine guns. Like shock troops they were given rests in preparation for use in offensives. As early as March they were known popularly as "Schlachtstaffel," and by September were so called in official documents in place of the former "Schutzstaffel."

Day Bombing:—The operations of aircraft against troops included the use of bombs; and it was remarked in March that both protective and reconnaissance planes carried them for the first time. The smallest ordinary bomb proved too heavy for this use. A new bomb, weighing about two pounds and bursting a short distance above the ground, was therefore produced. The characteristic feature of day bombing is its employment against living targets. But fixed objectives were also set, both for the two-seaters and for certain units of large bombing planes, which were designated for daylight work.

Long-Distance Bombing:—An important feature of operations was the systematic bombing of rear-area points located by the preliminary reconnaissance. Just before an offensive the airdromes were attacked, to co-operate with the pursuit barrage in keeping off observers; during the fighting centers of supply, concentration and communication were the objectives. The work was done mostly at night and by the largest types of machines. It proved extremely effective in the first offensive and was carried out in later ones, whenever the weather allowed. Bombing has an equal importance in defensive warfare, as is evidenced by the recent creation of two new squadrons. It has been resorted to in hindering preparations for an expected attack.

SOME LUDENDORFF DICTA

"In general too much temerity is less harmful than too much timidity. It is only when the troops are hurled at the enemy without hesitation that great success is achieved." (Order, June 9).

"The attack does not go on merely mechanically; commanders must command; every man must act on his own initiative." (Memo. Jan. 25).

"Skillful leadership on the part of higher and subordinate commanders, in accordance with the tactical situation at the moment, is required during the attack." We "must differ essentially in this respect from the attacks hitherto undertaken by the British. They believed in the efficacy of their skillfully worked out but rigid artillery barrage. This was to carry forward the infantry attack which advanced without any impetus of its own. The subordinate and, still more, the higher commanders ceased to have any further influence." (Memo. Jan. 25).

"For the higher commands the most important matters are economy of forces and the proper engagement of reserves." These will, as a general rule, be put in "at the points where the attack is still in movement and its progress can be facilitated with a view to breaking down the enemy's resistance in the neighboring sector by rolling it up from flank to rear." (Memo. Jan. 25).

"The idea of compelling success by the employment of masses of troops must be absolutely eradicated. This merely leads to unnecessary losses. It is fire effect which is decisive, and not numbers." (Memo. Mar. 30).

"We must be on our guard against excessive centralization and paper schemes. They lead to . . . . top-heavy staffs without proportionate returns."

"It is certain that everywhere great interest and understanding have been applied to the importance of training. Wherever it failed the fault lay in the lack of time." (Order, June 9).